Research Paper | Zoology | E-ISSN No : 2454-9916 | Volume : 3 | Issue : 5 | May 2017

CHEMISTRY OF WATER AND SEDIMENT OF FRESH RESERVOIR OF GULBARGA DISTRICT, KARNATAKA

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ABSTRACT

In the present study the physicochemical characters of water and sediment of freshwater reservoir were studied for the period of one year. Heavy metals concentration was determined by Atomic absorption spectrophotometer (GBC 902, double beam). All the physic-chemical parameters are within the permissible limits and the reservoir is productive in nature.

KEYWORDS: physico-chemical parameters, heavy metals, sediment.

INTRODUCTION

The water and sediments play a key role in any aquatic ecosystem. Most of the reservoirs water is stagnant, it is important to study the properties of sediments and quality of water, as the pollutants or contaminants are entered in to the system through organically (or) inorganically to the sediment. The sediment of any aquatic ecosystem is a place to catch run off and uphold the water while the soil and dead particles of organism or plants in the water settled and turned into the sediment.

Human activities such as rapid industrialization, urbanization, modern civilization, economic development and increased population are the major cause for eutrophication of aquatic ecosystems. The utilization of nutrients and entry of nutrients of aquatic ecosystem by surface run off is determines the quality of fresh water aquatic ecosystem. Along with nutrients, trace metals, heavy metals and synthetic organic chemicals from surrounding runoff can accumulate in the sediments of aquatic ecosystems and also in the biological components of the ecosystem.

According to the Pathak *et al.,* (1992), in the fresh water aquatic environments, sediments have a high pollution capacity particularly for trace and heavy metals. A number of of the elements are considered to be highly hazardous to aquatic life and human.

Any kind of metals can never be completely eliminated once they entered in to aquatic ecosystem water body. They persistent in sediment and slowly get released causing serious health problems and other kind of hazards to aquatic biota through the food chain (Campbell and Stokes, 1985). Mishra and Jha, (1996) and Mathis and Cummings, (1971), reported that, water pollution may affect the biochemistry of hydrophytes and also affecting any aquatic ecosystem synergistically of antagonistically when existing in grouping with other pollution may cause decrease in biological diversity. The toxicity of metals may depend on the physical and chemical properties of water. The physic-chemical characters of water may also indicate the quality aquatic life.

The Khaja-Kotnoor reservoir is situated 20 km away from Gulbarga University. It is a one of the major reservoir in this region for agriculture, a source of potable water, economic application for fish production . This reservoir receives the water from surroundings during the monsoon seasons. The availability of water in this reservoir depends on the rain in its surrounding area and in the vicinity of river.

The human and agriculture activities in its catchment area are the main source of water pollution such as pesticides and their chemical compositions. The present study an attempt has been made to evaluate the physicochemical characters of water and sediment of the reservoir.

MATERIALS AND METHODS

Samples of water and sediment were periodically collected from three sites of Khaji Kotnoor reservoir during October 2015 to September 2016. The parameters such as pH,. Alkalinity, Chloride, Hardness and Dissolved Oxygen, were analyzed according the APHA(1998).

The sediment (0.5 gm) were digested in borosilicate glass tube with the addition of nitric acid and perchloric acid (4: 1) by putting the tubes in water bath for 5 - 6 hours or upto clear digestion of sample. After cooling, each sample was diluted upto 10 ml with distilled water and kept in plastic container. The water samples were used directly for analysis. The samples were analyzed by calibrated GBC 902, double beam Atomic Absorption Spectrophotometer (AAS).

RESULTS AND DISCUSSION

Physicochemical properties of water

Variation in physicochemical properties of water of Khaji Kotnoor reservoir presented in Table1 and 2 respectively.

The maximum mean temperature of Khaji Kotnoor reservoir was recorded in June, and minimum mean temperature was recorded in December (Table.1.).

At Khaji Kotnoor reservoir the pH of water was found to be alkaline throughout the study period year. The maximum alkaline pH (8.3) was recorded in May. It ranged from 7.8 to 8.2. Singh and Roy (1995) , and Kumar *et al* (1989) were also reported in their studies and similar average pH values were recorded while studying fresh water ecosystems. The high values attribute to the high rate of photosynthesis and this increase trend clearly indicates that, the productive nature of reservoir. According to Kaur *et al* (1996), some aquatic ecosystems are failed to express seasonal changes in their pH values due to the several factors and intense algal activity causes the pH to rise sharply as carbon dioxide, present as carbonic acid, is utilized. Algae often raise the pH in surrounding water to as high as 10, at which point calcium carbonate precipitates and often forms a marl layer on the bottom of the lakes.

Alkalinity of water is acid neutralizing capacity. In the natural water the alkalinity is due to the salts of carbonate, borate, silicate, and phosphate along with hydroxyl ions in the Free State. During the study period, Khaji Kotnoor reservoir showed high values of alkalinity during the summer's months (May) and low values were recorded during the winter months. However, throughout the study period it was found to be below the acceptable limit of 200 mg/L.

Chloride as chloride ions is normally present in natural water. The salty taste shaped by chloride depends on the chemical characters of water. The presence of chlorides above the acceptable limits can also be used as an indicator organic pollution. The chloride at Khaji Kotnoor reservoir was found in the range of 21.5 to 79.1 mg/ml. The maximum values of chloride were recorded in summer season; this may be due to the high rate of water evaporation from the reservoir. Chaturvedi *et al* (1996) who found the chloride content in the water of Kolar dam within the acceptable limit and similar observation were made in the present investigation.

The hardness in the water is the measure of capacity of water to react with soap. It is caused by divalent cation, principally calcium and magnesium. During the study period, the total hardness was ranged from 30.2 mg/L to 119.8 mg/L. The maximum value in hardness was recorded in May, and minimum value was recorded in October. The total hardness was found below the permissible limit throughout the study period.

In the present work total hardness of water of Khaji Kotnoor Reservoir was found to be less than the sum of carbonate and bicarbonate alkalinity. Thus all the observed hardness was carbonate hardness and that was within the required acceptable limit of 200 mg/L. Water of Khaji Kotnoor Reservoir could thus be considered from soft to moderately hard.

The maximum dissolved oxygen in the water of Khaji Kotnoor reservoir was recorded during winter and from late winter it started declining. The minimum

values were recorded in the month of June. In summer the dissolved Oxygen in the water of Khaji Kotnoor water Reservoir was found to be lower in comparison to winter season.

Chase (1988), reported that the warmer the water, the less is the oxygen it can hold. During the summer season the temperature and decomposition of dead organisms in water may also reduce oxygen concentration where it is used in the process of decomposition. High amount of nutrients loads, especially during warmer periods, increases the respiration rate among the biota of aquatic ecosystem; hence there is reduction in dissolved Oxygen. The quality of Khaji Kotnoor water Reservoir was markedly deteriorated in summer season as the water at the banks turned to a pea soap appearance, which might be due to algae buoyed up by minute oxygen foam. Algal blooms may also reduce the dissolved Oxygen.

Heavy Metals In water and sediment

During the study period, the monthly variation in the concentration of lead in the water is analysed and presented in the respective table. Forstner and Wittman (1979), reported in their studies that, the concentration of soluble lead in uncontaminated fresh water is generally 3.0 µg/L with background concentration in the range of 5-50 µg /L.

The present results are in correlate with the study of Panday and Das (1980), who revealed high concentration of lead in water of Lake in Nanital respectively. The level of lead in water was found to be higher than the level recommended by Indian Standard Institution (ISI, 1982). According the EPA (1987), the criteria laid down for lead level in aquatic life protection ranges from 1.3 to 7.7 µg/L. Higher level of lead may be adversely affect the growth of aquatic life.

The zinc concentration in the of Khaji Kotnoor is within the permissible limits of the prescribed standards, however, the high concentration of zinc was noticed during the southwest monsoon season. This condition is clearly indicate that, high amount of runoff water enter in to the reservoir from the sorrowing agriculture field. This is the main sources of enter the zinc metals in to the reservoir.

According to the Dicks and Allen, (1983), the bioavailability of these metals is prejudiced by physico-chemical interaction of the aquatic ecosystem. Thapalia *et al* (2015) and Nishumara and Kumagai (1982) have revealed that polluted sediments as the primary source of fish pollution in most of the aquatic ecosystem. The levels of metals in sediments may reflect the nature of overlying water and also the level of metal contamination in the organisms inhabiting the sediment water interface.

The industrial and anthropogenic activities in the catchment area may be a major source of heavy metal to the water bodies (Suthar et. al., 2009). The variations in the concentration of heavy metals may be attributed to anthropological activities in their vicinity. The lead and zinc concentration in the sediment of Khaji Kotnoor Reservoir were not in the categories of moderate or polluted level. The mean concentration of lead in sediment was 3.0 ppm (DW), while that of zinc was 31.0 ppm (DW). This concentration may be considered as background concentration in sediments. The levels of heavy metals in the sediment cannot be considered polluted or moderately polluted because the levels were below the permissible limit. The concentration of zinc in sediment is correlate with the results of Friant (1979), Barman and Lal (1994) , and Ganapathy and Pillai (1975). Elder and Mattraw, (1984) stated that, lead concentration in the sediment can be considered safe as it ranged within the permissible limit and even safe for aquatic biota. Concentration of Lead level in the sediment is in similar with the study of Barman and Lal (1994), Pheiffer (1972), Moore and Sutherland (1981), and Mathis and Cummings (1973). The concentration of heavy metal in water and sediment may be influenced by on the physic-chemical properties of water and sediment.

Conclusion

Any metals, particularly heavy metals enter in the ecosystem in a relatively non or less toxic form and become central components of the environment in such a way that it is complex to remove them from the respective aquatic ecosystem. The heavy metals like lead and zinc were found in water and sediment of reservoir and more concentration was found to be in water than the sediment. Therefore, extensive agriculture, industrial and anthropogenic activity may be a source of contamination other than background concentration.

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Table 1: Physicochemical properties of water of Khaji Kotnoor Reservoir

	Oct.	Nov.	Dec.	Jan	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sept.
Temperature(^{0}C)	23.1	22.7	18.8	20.3	21.1	21.0	28.1	26.5	31.0	27.1	27.4	28.4
pH	7.8	8.1	8.2	8.2	8.0	7.8	8.0	8.2	8.1	7.8	7.9	8.0
Alkalinity(mg/l)	60.7	123.1	115.4	147.5	118.2	133.2	168.2	210.1	182.6	145.7	142.1	121.6
Chloride(mg/l)	29.4	21.5	40.1	39.4	34.5	26.1	29.4	54.1	66.1	79.1	72.0	51.2
Hardness(mg/l)	30.2	72.4	81.2	84.5	106.2	107.2	117.8	119.5	92.1	116.5	112.0	87.4
DO(mg/l)	9.4	12.0	12.4	13.2	12.8	8.0	9.6	5.7	5.6	5.4	5.0	11.2

Table 2: Heavy Metals in water and sediment of Khaja-Kotnoor Reservoir

MONTHS	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug	Sep	
Water(µg/ml)													
Lead	Mean	0	0.008	0.058	0.0133	0.0527	0.02	0	0.015	0.01	0.052	0	0
	SEM	0	0.007	0.051	0.0112	0.02	0.007	0	0.007	0.007	0.035	0	0
Zinc	Mean	0.110	0.181	0.187	0.489	0.078	0.008	0	0.187	0.269	0.27	0	0
	SEM	0.088	0.153	0.152	0.392	0.064	0.007	0	0.079	0.096	0.12	0	0
Sediment(µg/mg)													
Lead	Mean	0.016	1.592	0.562	3.02	5.33	12.3	2.27	2.05	0.98	2.92	0	0
	SEM	0.02	0.510	0.253	0.163	0.355	0.005	0.366	0.26	0.036	1.33	0	0
Zinc	Mean	2.7	2.19	4.77	5.24	174.6	10.51	5.48	97.72	3.13	4.13	0	0
	SEM	0.59	1.08	0.658	0.308	27.03	7.458	0.454	25.94	0.34	0.437	0	0